The Journal of Laryngology & Otology (2006), ***120***, *776–777.*

doi:10.1017/S0022215106001848
Printed in the United Kingdom
First published online 3 July 2006

Short Communication

Modified neodymium-YAG laser in rigid bronchoscopy

Y-H Liu, M-S Lu, Y-C Wu, P-J Ko, H-P Liu

Abstract

The use of laser bronchoscopy in the treatment of tracheobronchial stenosis has been reported in the past. It is generally safe and effective; however, the complications of haemorrhage, airway perforation, or airway fire are relatively frequent among less experienced surgeons. We illustrate a modified technique of laser probe location to simplify the laser ablation procedure.

Key words: Constriction, Pathological; Laser Surgery; Bronchoscopy

Introduction

Neodymium-YAG (Nd-Yag) laser is currently a popular technique for surgical treatment of tracheobronchial stenosis. Several authors have demonstrated the safety and efficacy of laser bronchoscopy in treating airway lesions.[1–4] However, complications such as airway fire, airway perforation, and massive haemoptysis still occur when laser bronchoscopy is performed by inexperienced physicians.[2–6] Some approaches have been proposed to avoid surgical complications and ensure the safety of laser recanalization and vaporization of airway lesions. Dumon *et al.* proposed using a swivel mounted T-tube adapter to facilitate insertion of a suction catheter and laser fibre to produce an adequate environment for airway surgery.[7] However, this report presents a novel modification to laser bronchoscopy using a laser fibre attached to a telescope to facilitate airway treatment.

Operative technique

Operations were performed under general anaesthesia. After establishing a safe airway, a rigid bronchoscope is introduced transorally or via a tracheal stoma using the standard procedure. Following endoscopic evaluation of the tracheobronchial tree and airway lesion, the telescope is employed for laser ablation preparation. The laser fibre is placed adjacent to the scope and fixed with an adhesive strip 1 cm away from the telescope tip. The telescope with the laser fibre is introduced via the working channel of the rigid bronchoscope and is progressed into the tracheobronchial lesion. The lesion is ablated using a pulse model (0.5 sec) at 20 W. The metal suction tube is placed parallel to the telescope and the smoke and airway secretions are removed by suction to facilitate the airway procedure. Diluted epinephrine is employed to irrigate the operative field for haemostasis when minor haemorrhaging occurs. After the stenotic airway is entirely ablated, the airway stent is introduced to alleviate the remaining stenosis. The T-tube is utilized for tracheostomy patients. In patients without tracheostoma, a silicone stent is used for benign lesions and a metallic stent for cases of malignant stenosis.

Results

Between April 2002 and March 2004, 37 procedures were performed on 30 patients with airway stenosis. Median patient age was 43 years. Ten patients were female and 20 were male. Diagnoses were as follows: 12, tracheostomy; six, post-intubation; four, primary tracheal tumour; three, inhalation injury; one, congenital anomaly; one laryngotracheal injury; one, anastomotic stricture; one, tuberculosis; and one, oesophageal cancer. Stenosis locations were upper trachea ($n = 24$), middle trachea ($n = 1$), lower trachea ($n = 3$), and main bronchus ($n = 2$). All procedures were performed without complications. Clinical status of 29 (96.6 per cent) patients improved. In one patient, the T-tube was not tolerated due to sputum impaction. No major or minor surgery related complications occurred.

Discussion

After Laforet *et al.* first described the laser ablation of an endobronchial lesion in 1976,[8] laser bronchoscopy became a good therapeutic modality for treating central airway stenosis. The studies by Dumon and Cavaliere demonstrated that laser bronchoscopy for airway stenosis is effective.[2–4] With the modern laser bronchoscopic procedure, flexible bronchoscopy has been used for laser bronchoscopy. Several safety considerations exist when employing Nd-Yag laser bronchoscopy: using the short-pulsed mode (0.5–1 sec); low power density (<45 W); fractions of inspired oxygen (FiO_2) reduced to 50 per cent; and ablation of the lesion in a parallel direction to the airway lumen.[3,4] Concerns remain about laser bronchoscopy complications, notably, perforation of the airway and great vessel can result in morbidity and mortality.

Already technically demanding, laser bronchoscopic procedures are more challenging for less experienced surgeons and bronchoscopists. The initial techniques described by Dumon comprise three components (telescope, laser fibre, and suction catheter) inserted via the side port of a Dumon–Harrell Universal Bronchoscope.[7] Laser ablation procedures using Dumon's technique are performed by rotating the entire bronchoscope to obtain the desired laser probe position (Figure 1a and 1b). In our opinion,

From the Division of Thoracic & Cardiovascular Surgery, Chang Gung Memorial Hospital, Chang Gung University, Taiwan, ROC, China.
Accepted for publication: 7 March 2006.

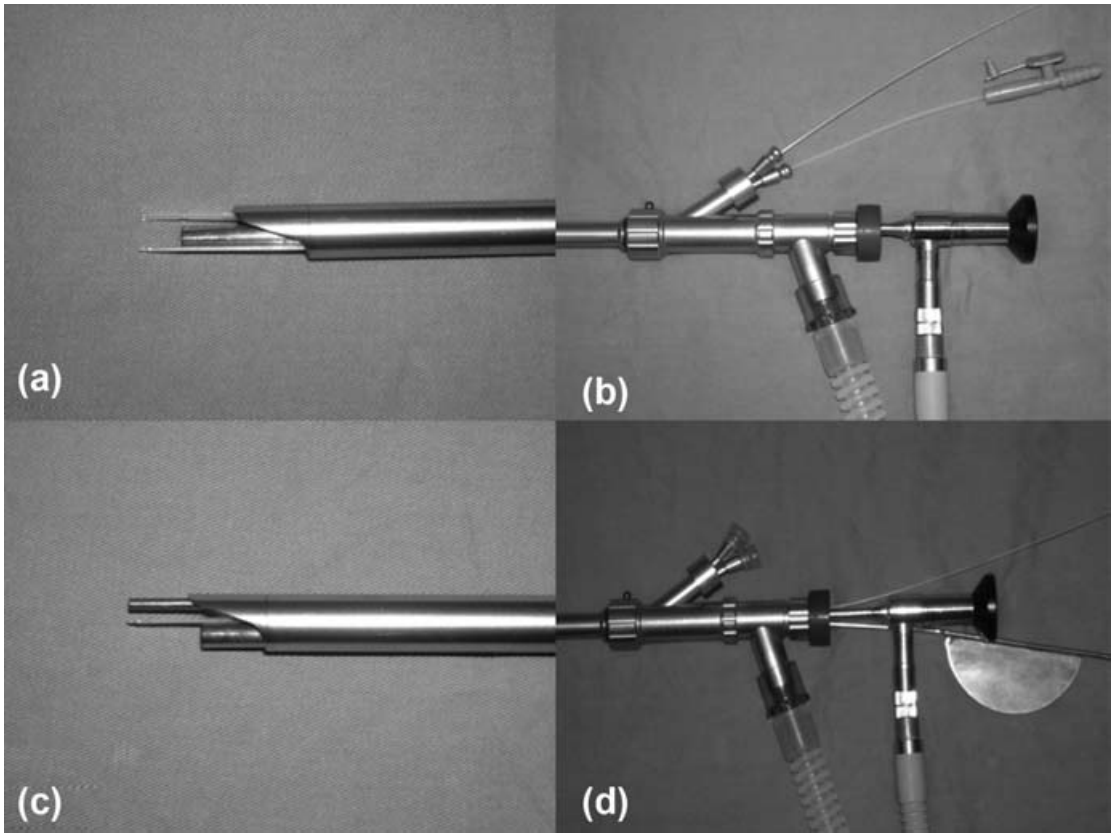

FIG. 1

(a) & (b) Current technique described by Dumon,[7] which inserted the laser fibre and suction catheter via the side port of the rigid bronchoscope, requiring meticulous surgical skill to perform suction procedure and laser ablation during telescope movement. (c) & (d) The modified technique, which attached the laser fibre to the telescope, allowing simultaneous laser ablation and suction manoeuvres while moving the telescope during laser bronchoscopy.

this procedure increases difficulties when performing laser ablation and suction manoeuvres while moving the telescope. This technique was modified by attaching a laser fibre to the telescope (Figure 1c and 1d). This novel approach is simple and effective and it is possible to perform all procedures simultaneously. This novel technique resulted in improved visualization of airway lesions, easy location of the tracheal or lobar stenotic lesion (via a telescopic guide), and ablation of the lesion simultaneously. Furthermore, the metal suction tube adjacent to the telescope can be used to suction secretions and blood clots to facilitate enhanced assessment of the airway lesion. This technique has not been described in the literature.

In conclusion, the proposed technique has proven effective and efficacious when applied to treating tracheobronchial stenosis. We believe this technique increases the ease of some procedures in laser bronchoscopy, and is especially useful to inexperienced surgeons who are technically skilled at laser bronchoscopy.

References

1 Colt HG, Harrell JH. Therapeutic rigid bronchoscopy allows level of care changes in patients with acute respiratory failure from central airways obstruction. *Chest* 1997; **112**:202–6
2 Cavaliere S, Venuta F, Foccoli P, Toninelli C, La Face B. Endoscopic treatment of malignant airway obstructions in 2,008 patients. *Chest* 1996;**110**:1536–42
3 Cavaliere S, Foccoli P, Toninelli C, Feijo S. Nd:YAG laser therapy in lung cancer: an 11-year experience with 2,253 applications in 1,585 patients. *J Bronchol* 1994;**1**:105–11
4 Dumon JF, Reboud E, Garbe L, Aucomte F, Meric B. Treatment of tracheobronchial lesions by laser photoresection. *Chest* 1982;**81**:278–84
5 Wegrzynowicz ES, Jensen NF, Pearson KS, Wachtel RE, Scamman FL. Airway fire during jet ventilation for laser excision of vocal cord papillomata. *Anesthesiology* 1992;**76**: 468–9
6 Denton RA, Dedhia HV, Abrons HL, Jain PR, Lapp NL, Teba L. Long-term survival after endobronchial fire during treatment of severe malignant airway obstruction with the Nd:YAG laser. *Chest* 1988;**94**:1086–8
7 Dumon JF, Shapshay S, Bourcereau J, Cavaliere S, Meric B, Garbi N *et al*. Principles for safety in application of neodymium-YAG laser in bronchology. *Chest* 1984;**86**:163–8
8 Laforet EG, Berger RL, Vaughan CW. Carcinoma obstructing the trachea: treatment by laser resection. *N Engl J Med* 1976;**294**:941

Address for correspondence:
Dr Po-Jen Ko,
Division of Thoracic & Cardiovascular Surgery,
Chang Gung Memorial Hospital,
5, Fushing Street, Gueishan Shiang,
Taoyuan, Taiwan 333,
Republic of China.

Fax: 00 886-3-3285818
E-mail: 15710111@cgmh.org.tw

Dr P J Ko takes responsibility for the integrity of the content of the paper.
Competing interests: None declared